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August 1, 2008

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: *Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band* (WT Docket No. 07-293) and *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band* (IB Docket No. 95-91)

WRITTEN EX PARTE PRESENTATION

Dear Ms. Dortch:

While there are few things on which the Wireless Communications Service ("WCS") and the satellite Digital Audio Radio Service ("SDARS") licenses agree in this proceeding, both sides recognize that path loss – the attenuation of a transmitted signal between two points – plays a critical part in determining whether SDARS subscribers are likely to suffer material interference from WCS mobile devices. The greater the path loss, the less likely interference is to occur. Unfortunately, although both sides agree on the importance of path loss, they continue to disagree on the specific path loss that will occur between a WCS mobile transmitter and a SDARS receiver at three meters separation. [1]

The WCS Coalition has made previous filings setting forth the results of path loss studies. Those studies focused on unobstructed propagation paths between the WCS transmitter and the SDARS receiver, which represents a worst-case scenario from the perspective of interference potential.[2] The attached study "Path Loss Between WCS Transmitters and SDARS Receivers in Typical Vehicle Usage Scenarios" sets forth the results of additional path loss studies conducted under real world conditions that show the potential for interference to SDARS subscribers is even further diminished than the previous WCS Coalition filings indicated. The

[1] *See, e.g.,* Reply Comments of XM Radio Inc., WT Docket No. 07-293, *et al.,* at 18 (filed Mar. 17, 2008); Reply Comments of WCS Coalition, WT Docket No. 07-293, *et al.,* at Attachment A (filed Mar. 17, 2008)["WCS Reply Comments"].

[2] *See*, WCS Reply Comments Attachment A; Letter from Paul J. Sinderbrand, IB Docket No. 95-91, *et al.*, at Attachment A (filed May 9, 2008).

results of the study are not surprising. There will be additional path loss between WCS transmitters and SDARS receivers when operating under real world conditions, which means the likelihood of WCS to SDARS interference will be even lower than the WCS Coalition had previously suggested.

The characteristics of this study are very closely aligned to the "highly correlated time and spatial use cases" the SDARS licensees discuss in their recent ex parte.[3] In short, it is even more apparent from the attached study that the path loss to be expected between a WCS mobile transmit antenna and a SDARS receive antenna is greater than the SDARS licensees suggest, and is responsible in large part for the differences in their assessments of the potential for WCS to mute a SDARS receiver.

Pursuant to Sections 1.1206(b)(1) and 1.49(f) of the Commission's Rules, this letter is being filed electronically with the Commission via the Electronic Comment Filing System. Should you have any questions regarding this presentation, please contact the undersigned.

Respectfully submitted,

/s/ Mary N. O'Connor

Mary N. O'Connor

Counsel to the WCS Coalition

Attachment

cc (by email): Aaron Goldberger
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Julius Knapp
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Roger Noel
Tom Derenge
David Hu
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Robert Nelson

[3] *See, e.g.*, Letter from Patrick L. Donnelly and James S. Blitz, IB Docket No. 95-91, *et al.*, Attachment at 6 (filed July 9, 2008).

Steven Spaeth
Shabnam Javid
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Path Loss Between WCS Transmitters and SDARS Receivers in Typical Vehicle Usage Scenarios

August 1, 2008

1 Executive Summary

The interaction of WCS transmitters and SDARS receivers is influenced by a number of variables, which behave independently, or are known to have nondeterministic occurrences. Several of these variables need to be present simultaneously for interference from a WCS transmitter to an SDARS receiver to occur.

The path loss between the WCS transmitter and SDARS receiver is one such factor. Path loss itself is not the sole determinant of whether harmful interference will occur, but is an indicator of the WCS signal levels that may be incident on an SDARS receiver. The amount of path loss that will exist between a WCS transmitter and SDARS receiver is determined both by the separation distance and the presence of intervening or nearby obstacles, which diminish or impede the radiowave propagation.

Studies previously submitted to the FCC by the WCS Coalition and by XM Radio ("XM") and Sirius Satellite Radio ("Sirius") focus on a specific propagation condition, namely the path loss over an unobstructed propagation path between the WCS transmitter and SDARS receiver. Those studies concentrated on a propagation condition that might exist when a pedestrian WCS subscriber is within close proximity of a vehicular roof-mounted SDARS antenna.

In this paper, the WCS Coalition presents path loss results for other propagation conditions and their associated use cases, which are relevant to the coexistence of WCS and SDARS. Specifically, path loss measurements are provided for cases when a WCS transmitter and SDARS receiver are in the same vehicle, as well when the WCS transmitter and SDARS receiver are in different vehicles, but are otherwise in close proximity.

The results show that the path loss for these vehicle-related use cases is frequently 3 – 14 dB greater than what has been measured in the pedestrian scenario described in previous studies. The increased path loss occurs even over very small propagation distances, on the order of a meter of less. Since path loss and received power are inversely related, the increased path loss results in decreased WCS signal levels at the SDARS receiver, which in turn results in reduced interference potential.

This finding confirms two key claims made by the WCS Coalition in its filings. First, that the pedestrian user case with an unobstructed propagation path is worst case. Second, and most importantly, that given the additional path loss that will occur in non-pedestrian use cases, the occurrence of WCS to SDARS interference will be even lower than has been previously suggested in the WCS Coalition's filings.

2 Introduction

Path loss, or the attenuation that a signal undergoes in travelling over a path between two points, is a critical factor in determining the vulnerability of an SDARS receiver to interference from a mobile WCS transmitter. The impact of path loss on the potential for interference from WCS transmitters to SDARS receivers has received significant attention in studies submitted to the FCC relating to co-existence of WCS and SDARS.

The WCS Coalition has provided results of two separate measurement campaigns performed with actual SDARS antennas in the 2.3 GHz WCS band. The WCS Coalition's extensive field measurements indicate that path loss follows a 50.9 + 21.8log(d) relationship. These results show a + 12 dB loss in excess of free space at a 3 meter distance.

The SDARS licensees have also provided their own data, including references to studies, which they claim support their findings. The SDARS findings differ significantly from the findings of the WCS Coalition. The likely causes for these differences, which were described in a previously filed WCS Coalition white paper [1], include reliance by Sirius and XM on theoretical analyses that are not immediately relevant to the WCS-SDARS condition and on field tests that did not appear to be comprehensive or repeatable.

While the path loss between a WCS transmitter and SDARS receiver has been carefully studied by the WCS Coalition, the studies to date have focused on a specific propagation condition – an unobstructed propagation path between a WCS transmitter and SDARS receiver. For the purpose of measuring path loss, and for subsequent studies of out-of-band emissions impacts, examination of this condition is useful as it illustrates the maximum potential for interference. Even under this "worst case" condition, studies submitted by the WCS Coalition show a low probability of real world audio muting interference to SDARS receivers [2].

In many practical usage scenarios, however, it is unlikely that a WCS transmitter and SDARS receiver will experience an unobstructed propagation path. Even over distances of 3 meters or less it is likely that obstacles -- such as the metal and glass materials of the automobiles, the head and body losses of the WCS user, etc. -- will further diminish or impede the radiowave propagation.

In this report, the WCS Coalition presents path loss results for other use cases, which are relevant to the coexistence of WCS and SDARS. Specifically, path loss measurements are provided for cases when the WCS transmitter and SDARS receiver are in the same vehicle, as well when the WCS transmitter and SDARS receiver are in different vehicles, but are still in close proximity. The following report summarizes the results of these path loss measurements conducted at the facilities of Next***Wave*** Broadband Inc. in Del Mar, California from July 20 through August 3, 2007. Analysis of the results were completed by WCS Coalition members AT&T, Horizon Wi-Com, and NextWave.

3 Field Measurements

Field measurements were performed to characterize the path loss between a WCS transmitter and SDARS receiver in typical vehicle based use scenarios.

A spectrum analyzer was used to generate and measure signals. The spectrum analyzer's tracking generator was used to generate a continuous wave test signal that was fed to the WCS transmitter antenna. The test signal swept across the lower and upper WCS band frequencies. The spectrum analyzer then measured the power received by the SDARS antenna at the tracking generator's frequency. By transmitting a signal on a WCS antenna and measuring the power received by a nearby SDARS antenna, the amount of path loss between the antennas was determined.

For the tests, the SDARS antenna's low-noise amplifier was bypassed and a measurement lead was connected directly to the receiving antenna. This was done in order to ensure that the results would apply to all SDARS receiver systems, regardless of the amplifier employed.

Prior to field testing, the frequency response for the WCS and SDARS test antennas were characterized to ensure that they have a nominally flat response over the test frequency range. The spectrum analyzer measurement system was also calibrated to correct for losses in the transmitter and receiver cables and to improve the measurement's dynamic range.

Testing began with a WCS transmitter and an SDARS receiver in the same vehicle. The SDARS receiver was positioned both on the front roof and the rear roof of the vehicle, which is representative of original equipment manufacturer (OEM) installations of SDARS receivers. The WCS transmitter was positioned in all combinations of the two seating rows (front and rear), two sides (left and right) and two heights (ear and lap).

Testing continued with the WCS transmitter in separate vehicle from the SDARS receiver, with the transmitter vehicle in front of and behind the receiver vehicle. For these tests, the WCS transmitter was situated at ear level in the front left (driving) seat location.

In all, a total of 20 different test cases were conducted. For each test case, multiple frequency sweeps were performed and the path loss was computed for each of the data points captured by the spectrum analyzer. The median path loss was then computed from the entire ensemble of data for a given test case.

3.1 Equipment Configuration and Calibration

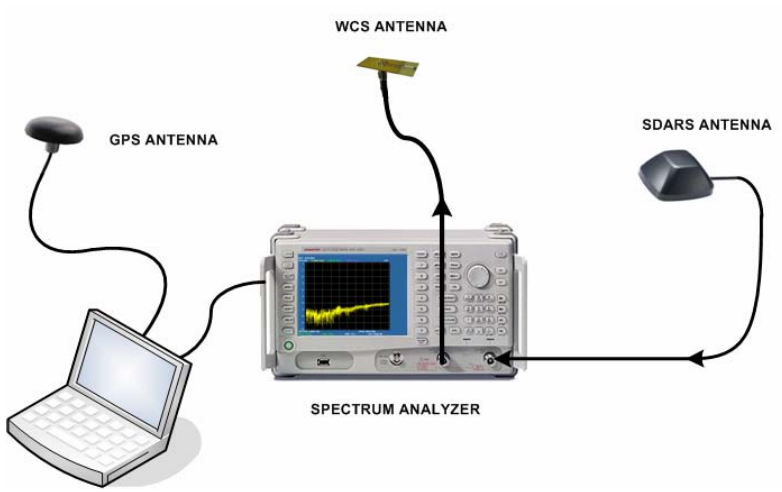
Prior to field testing, the WCS transmitter and SDARS receiver antennas were examined in the lab to determine their frequency response. An Agilent E5071B network analyzer was used to measure the power reflected by the WCS transmitter antenna and the SDARS receiver antenna.

For the lab and field measurements, the SDARS antenna's low-noise amplifier was bypassed and a measurement lead was connected directly to the raw antenna. This was done in order to ensure that the results could be generalized to all SDARS receiver systems, regardless of the characteristics of the low noise amplifier that is employed. In the lab tests, the SDARS antenna resonated at 2.34 GHz, confirming that its tuning was unaffected by these modifications.

Photographs of the WCS transmitter and SDARS receiver antennas, and their frequency response measurements, are contained in Appendix A.

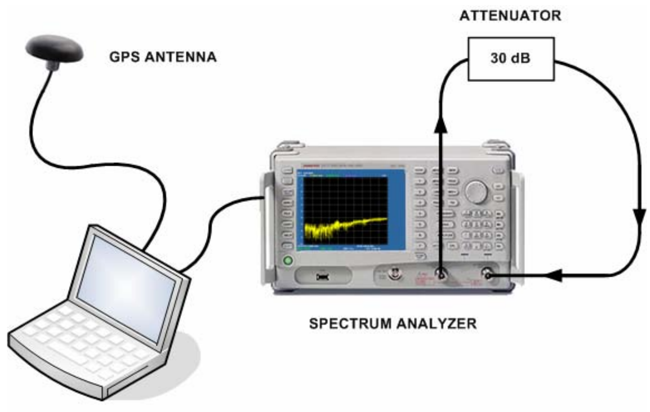
For the field tests, an Advantest U3751 spectrum analyzer was used to generate and measure signals. The spectrum analyzer's tracking generator was set up to drive the WCS transmitter antenna with a weak (1 milliwatt or 0 dBm) test signal which was swept across the WCS band frequencies. The spectrum analyzer then measured the power received by the SDARS antenna at the tracking generator's frequency. An illustration of the test configuration is provided in Figure 1. The test configuration applied here is equivalent to the configuration used for path loss measurements reported in [3] and [4].

Figure 1 – Measuring Path Loss Between WCS Transmitter and SDARS Receiver



Prior to recording data, the measurement system was normalized to correct for losses in the transmitter and receiver cables and to improve the measurement's dynamic range. In this procedure, illustrated in Figure 2, the transmitter and receiver antennas were disconnected and the spectrum analyzer's input and output cables were connected to a 30 dB attenuator. The received power was normalized to the +0 dBm output of the tracking generator, less the losses due to the cables and attenuator. This measured power was then recorded and subtracted out by the spectrum analyzer, so that +0 dBm was displayed for all frequencies. Since the measurement system was normalized to read +0 dBm with a 30 dB attenuator in place, a -30 dB correction was required to convert measured received power to true power values. The attenuator was then removed and the transmitter and receiver antennas reconnected per Figure 1 to allow measurements to begin.

Figure 2 – Removing Effect of Cable Losses



Five measurement sweeps were recorded for each WCS transmitter and SDARS receiver geometry tested. The raw measurements were adjusted per the 30 dB normalization factor as discussed above. The median received power was computed for each recorded measurement frequency using the corrected power measurements. Path loss was computed from the measured power according to the following equation:

$$Loss_{PATH} = Pwr_{TRANSMITTED} - Pwr_{RECEIVED}$$

Since the transmitted power was +0 dBm, the path loss amounted to a simple inversion of received power.

For the purpose of numerical comparison, median path loss was computed from the entire ensemble of path loss data points (i.e., over all frequency measurement sweeps). Median path loss was used in lieu of mean, or average, path loss to ensure that the computed result was not biased by outlier values in the data.[1]

For display purposes, the path loss data was binned by frequency and the median path loss at each frequency was computed. The median data was then smoothed to enhance the data display.

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[1] Calculation of medians is a popular technique in summary statistics and summarizing statistical data, since it is simple to understand and easy to calculate, while also giving a measure that is more robust in the presence of outlier values than is the mean. In this case, it was not possible to use conventional spatial averaging techniques on the measured data since the transmitter and receiver were stationary for the tests. Hence, median path loss rather than mean path loss will provide a more accurate measure of the typical path loss by removing the effects of small and large scale fading. Median path loss is routinely applied in studies that characterize path loss, see [5].

3.2 Test Scenarios

A total of 20 unique cases were tested to characterize path loss for different vehicle-base usage scenarios. The test cases encompassed scenarios where: a.) the WCS transmitter and SDARS receiver were in the same vehicle; and b.) the WCS transmitter was in a separate vehicle from the SDARS receiver, with the transmitter vehicle in front of and behind the receiver vehicle.

For added variability, the SDARS receiver was positioned both on the front roof and the rear roof of the vehicle, which is representative of original equipment manufacturer (OEM) installations of SDARS receivers. The WCS transmitter was positioned in all combinations of the two seating rows (front and rear), two sides (left and right) and two heights (ear and lap).

3.2.1 Transmitter and Receiver in the Same Vehicle

Antenna path loss was measured with a WCS transmitter and SDARS receiver in the same vehicle, as shown in Figure 3. The SDARS receiver was in one of the two positions shown and the transmitter in one of eight positions: either the front or rear row, the left or right seat, and at ear or lap height (as shown in Figure 4). This resulted in a total of 16 test geometries.

For both SDARS roof mount locations, the antenna was placed on the centerline of the roof in the fore and aft positions. Such placements are representative of the majority of OEM installations used by both XM and Sirius.

Figure 3 – Transmitter, Receiver Locations

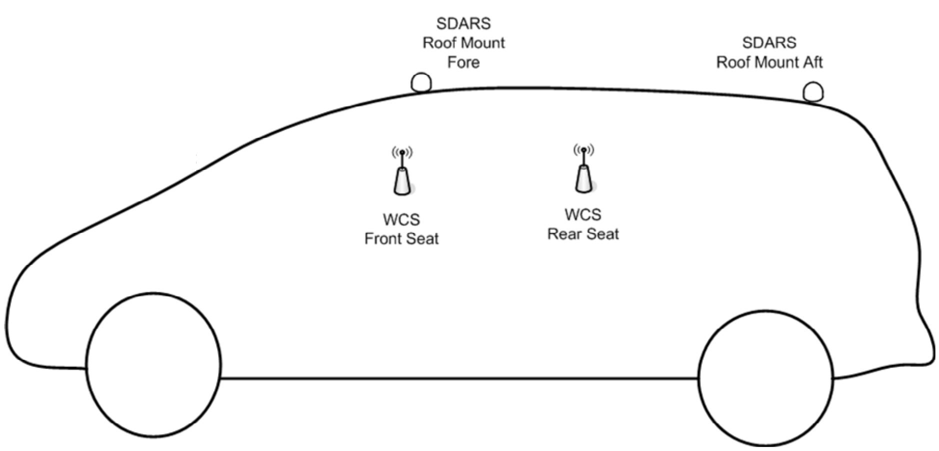
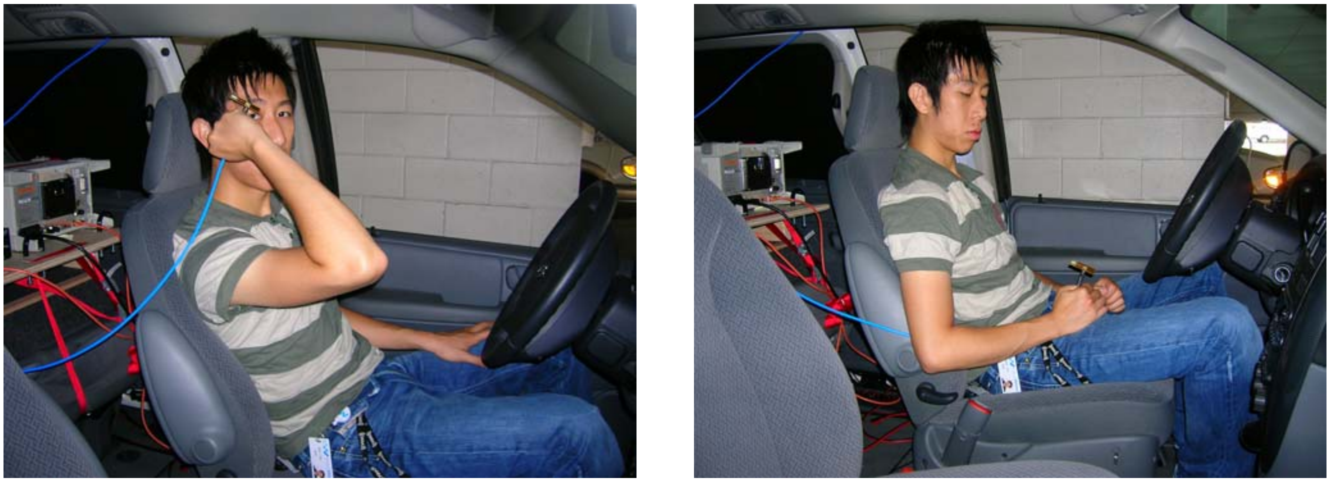


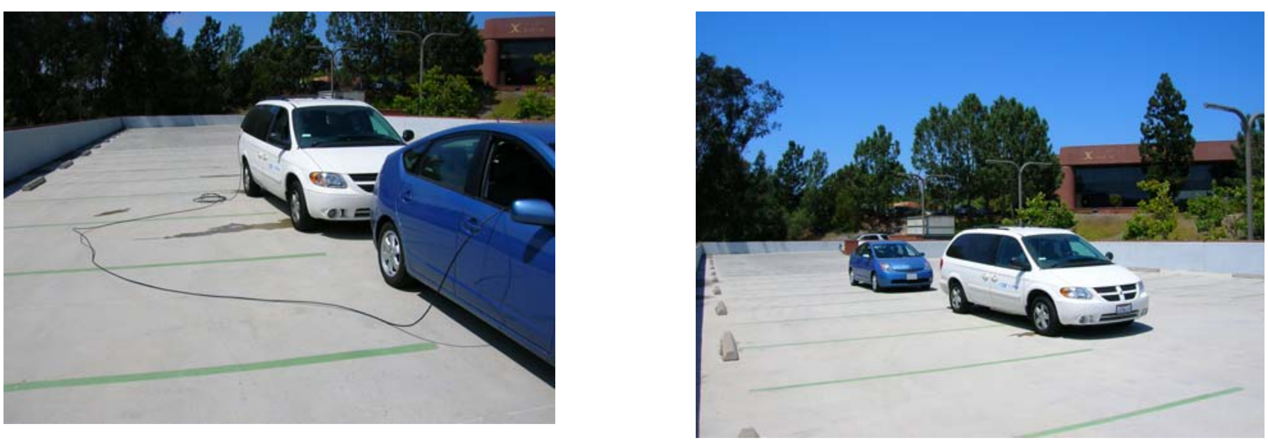
Figure 4 – WCS Transmitting Antenna at Ear (left) and Laptop (right) Heights



3.2.2 Transmitter in Separate Vehicle

Testing was performed with the SDARS receiver and WCS transmitter in separate vehicles. The receiver was positioned as before, mounted on both the forward roof and rear roof for different measurement runs. The transmitter was placed inside a sedan at ear height for the test cases where the transmitter was both in front of and behind the receiver vehicle, as shown in Figure 5.

Figure 5 – Relative Positioning of Vehicles with Transmitter (blue sedan) in front of, and behind, Receiver Vehicle (white van)



As can be seen in the pictures above, during the tests the vehicles were stationary and situated to represent vehicles stopped at a traffic signal or in traffic, which would likely result in the minimum possible vehicle-to-vehicle separation. Note that vehicles traveling at moderate to highway speeds would require additional separation to provide for adequate braking distances.

The specific distances between the WCS transmitter and SDARS receiver for these tests are listed in Table 1 below.

Table 1 – Average Path Loss Across the WCS Band for Same Vehicle Measurements

Test Scenario	Antenna-to-Antenna Separation
WCS Transmitter Vehicle in Front of Vehicle Front Roof-Mounted SDARS Receiver	4.4 meters / 14.4 feet
WCS Transmitter in Vehicle Behind Vehicle Front Roof-Mounted SDARS Receiver	7.2 meters / 23.6 feet
WCS Transmitter Vehicle in Front of Vehicle Rear Roof-Mounted SDARS Receiver	6.3 meters / 20.7
WCS Transmitter in Vehicle Behind Vehicle rear Roof-Mounted SDARS Receiver	5.4 meters / 17.7 feet

4 Path Loss Results

For each test case, multiple frequency sweeps were performed and the path loss was computed for each of the data points captured by the spectrum analyzer. For numerical comparison, median path loss was computed from the entire ensemble of path loss data points. For display purposes, the path loss data was binned by frequency and the median path loss at each frequency was computed. The median data was then smoothed to enhance the data display. The path loss results are provided below.

4.1 Transmitter and Receiver in Same Vehicle

The WCS transmitter was operated in the same vehicle as the SDARS receiver. The WCS transmitter was placed in each combination of the two seating rows (front and rear), two sides (left and right) and two heights (ear and lap). Measurements were conducted with the SDARS receiver mounted on the front roof and rear roof. With eight transmitter positions and two receiver positions, path loss was measured over 16 geometries in total.

Sample measurement results of average path loss versus frequency are provided in Figure 6 through Figure 8. The average path loss measurement results for each of the 16 test geometries are summarized in Table 2.

The median path loss plots for all 16 test cases are provided in Appendix B of this report.

Figure 6 – Path Loss Between WCS Transmitter at Ear Level in Front Left Seat and Forward Roof-Mounted SDARS Receiver

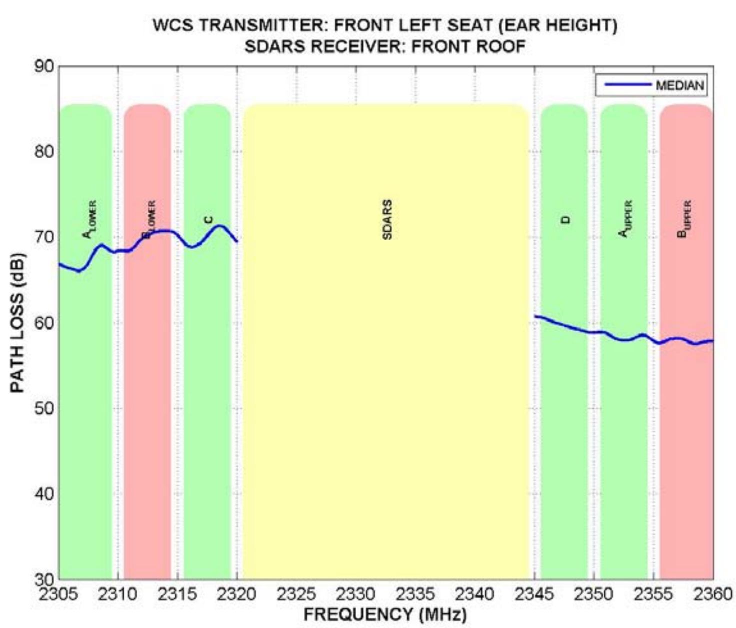


Figure 7 – Path Loss Between WCS Transmitter at Lap Level in Front Left Seat and Forward Roof-Mounted SDARS Receiver

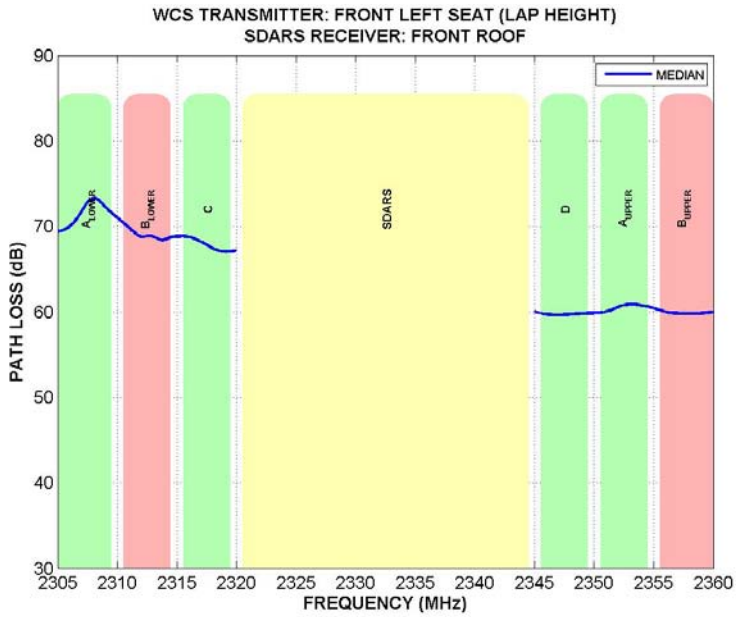
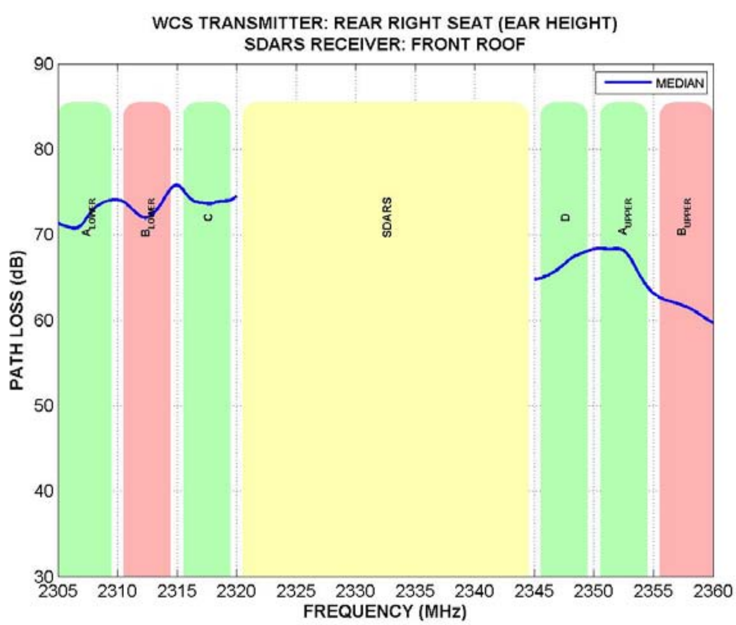


Table 8 – Path Loss Between WCS Transmitter at Ear Level in Rear Right Seat and Forward Roof-Mounted SDARS Receiver



4.2 Transmitter in Separate Vehicle

In this phase of testing, the SDARS receiver was again mounted on both the front and rear roof, while the WCS transmitter was placed in a separate vehicle that was in front and behind the receiver vehicle. For each measurement the WCS transmitter was placed at ear level in the front left seat. Figure 9 and Figure 10 show the frequency-dependent median path loss; and the median path loss results are summarized in Table 3.

Figure 9 – Path Loss Between WCS Transmitter Vehicle in Front of Vehicle with (A.) Front Roof-Mounted SDARS Receiver and (B.) Rear Roof-Mounted SDARS Receiver

(A.) **(B.)**

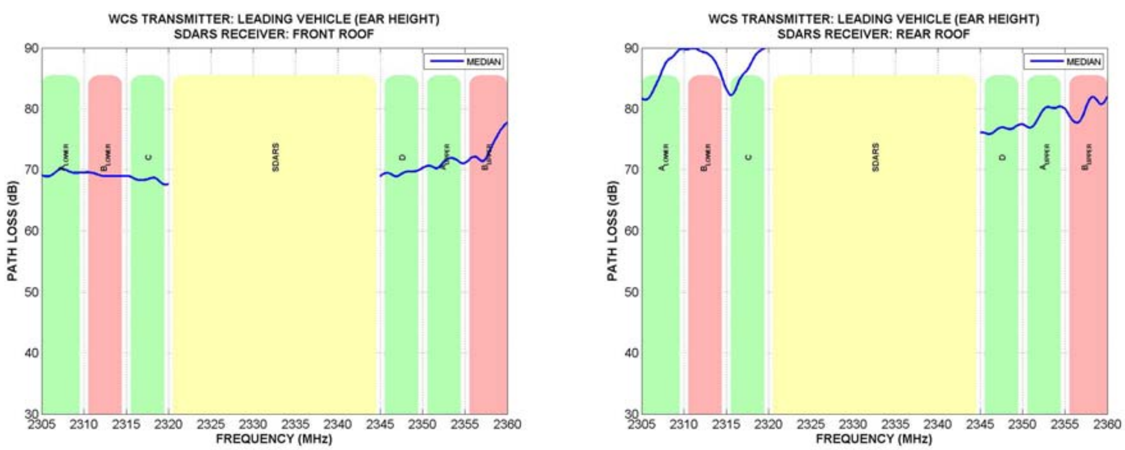
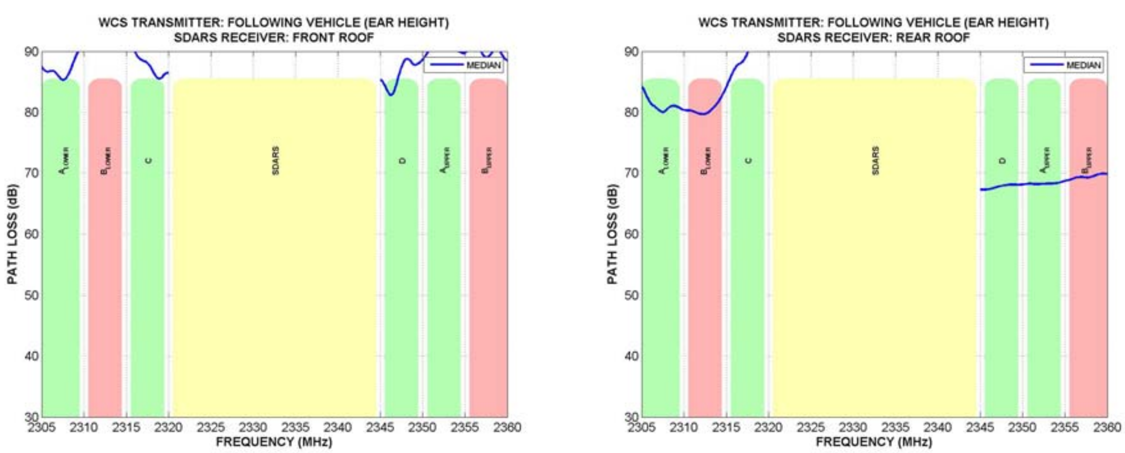


Figure 10 – Path Loss Between WCS Transmitter Vehicle Behind Vehicle with (A.) Front Roof-Mounted SDARS Receiver and (B.) Rear Roof-Mounted SDARS Receiver

(A.) **(B.)**



4.3 Median Path Loss Results

Table 2 summarizes the test results, listing the median path loss computed for each geometry for the same vehicle measurement condition. Table 3 summarizes the median path loss results for the different vehicle tests. For all measurements, the path loss corresponds to the median (50%) value for all measured data.

Table 2 – Median Path Loss Across the WCS Band for Same Vehicle Measurements

WCS Transmitter Position	Forward Roof Mounted SDARS Receiver	Rear Roof Mounted SDARS Receiver
Front Row Same Vehicle: Left Seat: Ear Height	63.0 dB	64.4 dB
Lap Height	63.9 dB	74.6 dB
Right Seat: Ear Height	64.6 dB	68.5 dB
Lap Height	62.7 dB	71.2 dB
Rear Row Same Vehicle: Left Seat: Ear Height	70.9 dB	61.5 dB
Lap Height	58.3 dB	61.8 dB
Right Seat: Ear Height	69.5 dB	64.4 dB
Lap Height	63.8 dB	56.4 dB

Table 3 – Median Path Loss Across the WCS Band for Different Vehicle Measurements

WCS Transmitter Position	Forward Roof Mounted SDARS Receiver	Rear Roof Mounted SDARS Receiver
Leading Vehicle	69.7 dB	79.9 dB
Following Vehicle	83.7 dB	73.2 dB

5 Conclusions

Overall, the measured data is consistent with expectations. The results for the use case with both devices in the same vehicle show more path loss than would otherwise be observed for an unobstructed propagation path at a three meter antenna-to-antenna separation. This additional path loss can be attributed to the impact of the vehicle roof, upholstery, etc. on the propagation of the WCS signal in the direction of the roof-mounted SDARS antenna. Similarly, the results for the tests conducted with the devices in different vehicles show path loss in excess of what would be expected if a completely unobstructed propagation path were to exist. Again, this additional loss is primarily attributable to the vehicle in which the WCS device is operating impeding the signal propagation.

5.1 General Observations

The graphical results provided in Sections 4.1, 4.2, and Appendix B show considerable variation in the measured median path loss with frequency. Visual inspection suggests that the variation range is in the 5 – 10 dB for a given measurement geometry. This variation is expected and conforms to generally accepted theory on the characterization of multipath propagation [6].

While both the transmitter and receiver are stationary during the tests, there are still multiple paths by which reflected, refracted, or diffracted signals arrive at the receiver. These signal combine in a coherent, or phase specific, manner and since the phase shifting of the various multipath signals is frequency dependent, the degree of constructive or destructive combination of these signals is frequency dependent as well. In essence, the variability of the results are due to the frequency selective nature of the wideband channel (i.e., the 30 MHz of WCS spectrum tested) [7].

5.2 Same Vehicle Path Loss Results

As discussed previously, the path loss between a WCS transmitter and SDARS receiver is expected to follow a loss versus distance relationship of *Path Loss = 50.9 + 21.8log(d)* dB when the propagation path is totally unobstructed. At the three meter coordination distance agreed to by WCS and SDARS, this relationship yields a path loss of 61.3 dB. The path loss computed at the three meter separation is a useful "path loss reference value" as subsequent analyses of out-of-band emissions (OOBE) impacts were referenced to this result. For example, tests performed by the WCS Coalition showed that it is highly unlikely that real-world muting at separation distances greater than 3 meters would result from relaxing the WCS mobile device emissions mask to the levels requested by the WCS Coalition [8].

Examining the results presented in Table 2, we see that the median path loss for 14 of 16 test scenarios is in excess of the path loss reference value. For most of the test cases, the path loss is 2 – 3 dB greater and in some cases the difference was as much as 8 - 10 dB.

This result is significant for two reasons. First, it illustrates that for practical usage scenarios, and at distances of a meter of less, the path loss between a WCS transmitter and SDARS receiver will be in excess to what would otherwise be observed at three meters with an unobstructed propagation path.

In consideration of the WCS Coalition's OOBE impact tests and analysis, the results further illustrate that it is unlikely that a WCS mobile device operating at the WCS Coalition's proposed emissions mask will cause any real world muting of an SDARS receiver, *even when both devices are in the same vehicle*.

5.3 Different Vehicle Path Loss Results

The results from the different vehicle path loss measurements are further analyzed in Table 4 below. In this table, the median path loss derived from the measured data is compared with free space path loss and the loss versus distance relationship for an unobstructed propagation path between an WCS and SDARS antenna.

Table 4 – Comparison of Median Path Loss for Different Vehicle Measurements with Calculated Unobstructed Path Loss

	WCS Transmitter Vehicle in Front of Vehicle with Front Roof-Mounted SDARS Receiver	**WCS Transmitter in Vehicle Behind Vehicle with Front Roof-Mounted SDARS Receiver**	**WCS Transmitter Vehicle in Front of Vehicle with Rear Roof-Mounted SDARS Receiver**	**WCS Transmitter in Vehicle Behind Vehicle with rear Roof-Mounted SDARS Receiver**
Antenna-to-Antenna Separation	4.4 meters	7.2 meters	6.3 meters	5.4 meters
Free Space Path Loss	52.6 dB	56.8 dB	55.7 dB	54.34 dB
Calculated Path Loss*	64.9 dB	69.6 dB	68.3 dB	66.9 dB
Median Path Loss from Measurements	69.7 dB	83.7 dB	79.9 dB	73.2 dB
Path Loss Difference (Measured - Calculated)	4.8dB	14.1 dB	11.6 dB	6.3 dB

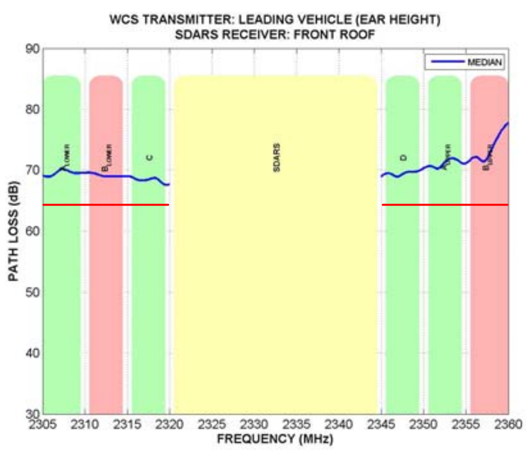
* Using the loss versus distance relationship of *Path Loss = 50.9 + 21.8log(d)* dB for a totally unobstructed propagation path, which the WCS Coalition has documented in prior filings and has used in its assessment of both path loss and out of band emissions impact.

The results show that in all cases, the measured path loss exceeded both free space path loss and the calculated path loss. The excess path loss in the measured results can be attributed to the shielding of the WCS antenna which will be operated inside the vehicle from the external, roof mounted SDARS antenna, head and body losses, as well as other factors. Together these effects ensure that path loss between a WCS transmitter and SDARS antenna will typically exceed the 61.3 dB of path loss that would be observed for an unobstructed propagation path. The unobstructed path loss condition studied previously by the WCS Coalition is clearly "worst case".

This finding is further illustrated in Figures 11 and 12 below. The measured median path loss as a function of frequency for the different vehicle test cases is displayed in these figures. A red line depicting the calculated path loss for the specific test case has been added to the figures. From visual inspection it is apparent that the median path loss for the different vehicle tests exceeds the calculated path loss over the entire frequency band. In some cases the measured path loss exceeds the path loss calculated for an unobstructed path by 20 dB or more.

Figure 11 – Path Loss Between WCS Transmitter Vehicle in Front of Vehicle with (A.) Front Roof-Mounted SDARS Receiver and (B.) Rear Roof-Mounted SDARS Receiver

(A.) **(B.)**



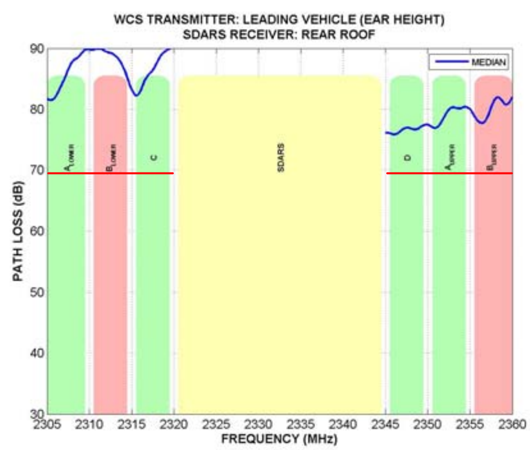
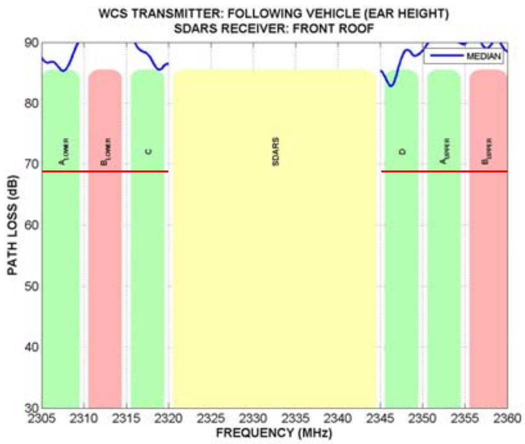
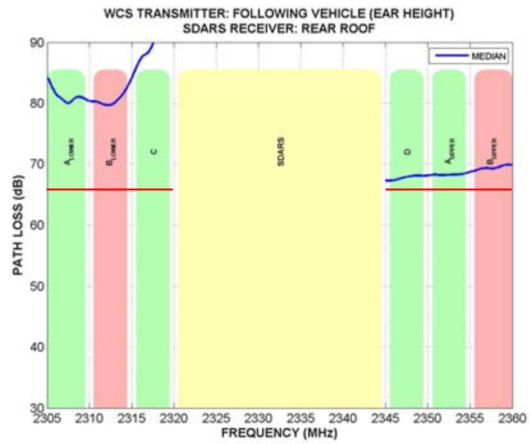


Figure 12 – Path Loss Between WCS Transmitter Vehicle Behind Vehicle with (A.) Front Roof-Mounted SDARS Receiver and (B.) Rear Roof-Mounted SDARS Receiver

(A.) **(B.)**





Again, comparing these result with the findings from the WCS Coalition's study of OOBE impacts, it is apparent that a WCS mobile transmitter is unlikely to cause audible muting of a nearby SDARS receiver in instances when the transmitter and receiver are operated in different vehicles.

6 References

[1] Letter from Paul J. Sinderbrand, Counsel to WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No 07-293, Attachment at 10 (filed May 9, 2008).

[2] Reply Comments of the WCS Coalition, WT Docket No 07-293, Attachment C (filed Mar. 17, 2008).

[3] Comments of the WCS Coalition, WT Docket No 07-293, Attachment B at 12 – 13 (filed Feb. 14, 2008).

[4] Reply Comments of the WCS Coalition, WT Docket No 07-293, Attachment B at 9 – 11, 14 – 15 (filed Mar. 17, 2008).

[5] DAVID PARSONS, THE MOBILE RADIO PROPAGATION CHANNEL, CH. 3 (1992).

[6] THEODORE RAPPAPORT, WIRELESS COMMUNICATIONS PRINCIPLES AND PRACTICES, CH. 4 (1996).

[7] DAVID PARSONS, THE MOBILE RADIO PROPAGATION CHANNEL, CHAPTER 6 (1992).

[8] Reply Comments of the WCS Coalition, WT Docket No 07-293, Attachment C (filed Mar. 17, 2008).

7 Appendix A

WCS and SDARS Test Antenna Characterization

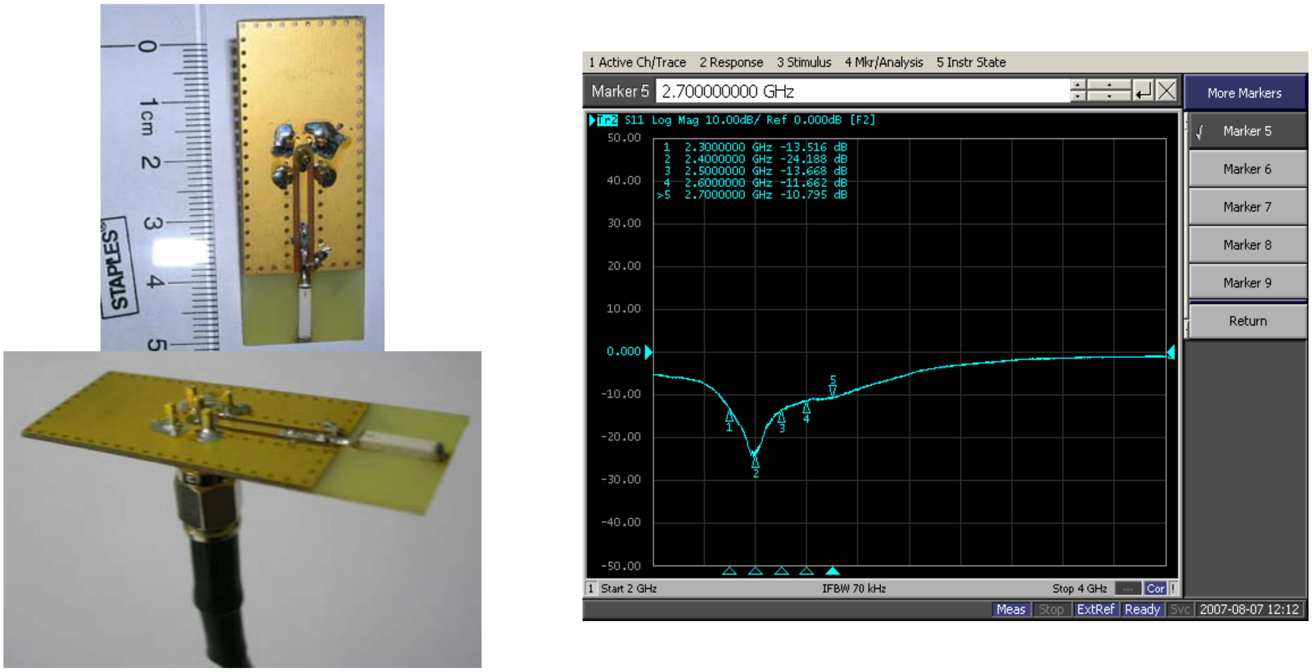


Figure A-11 – WCS Transmitter Antenna and Frequency Response

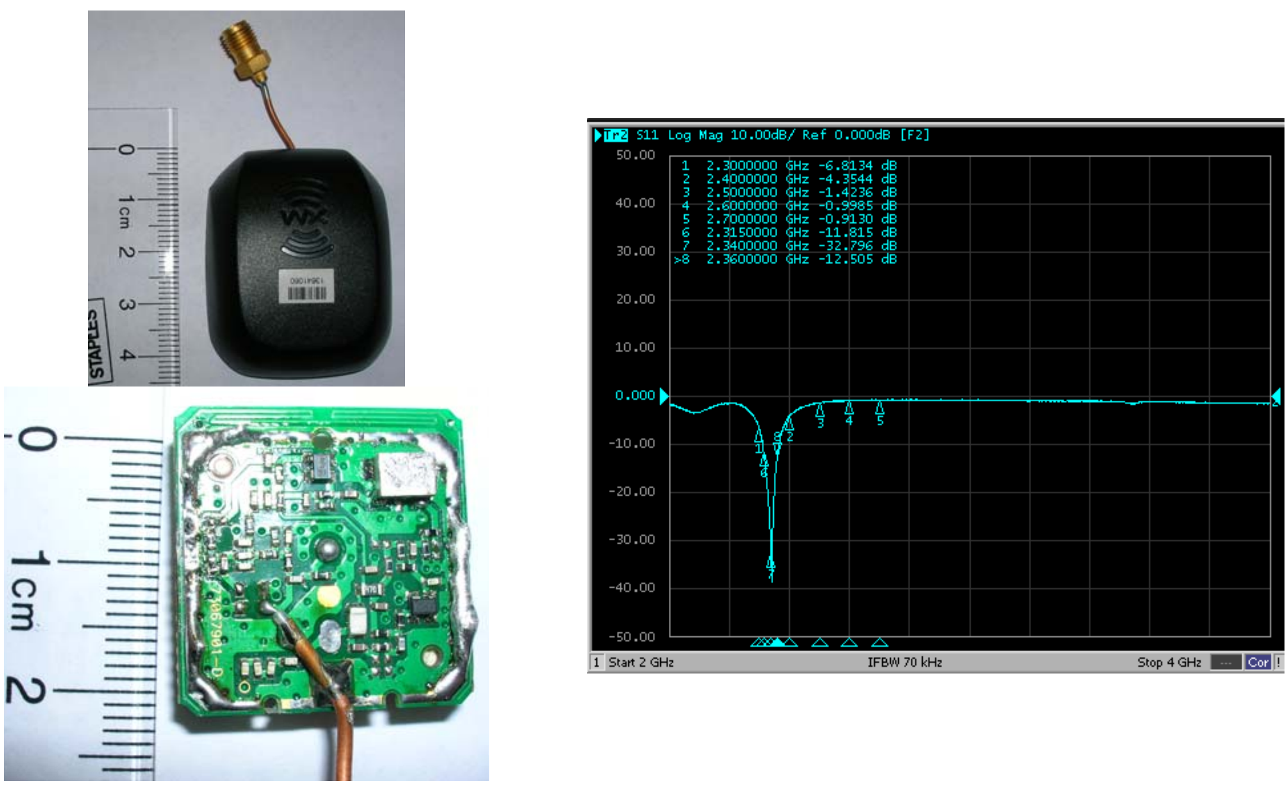


Figure A-12 – SDARS Receiver Antenna and Frequency Response

8 Appendix B

Same Vehicle Path Loss Measurements

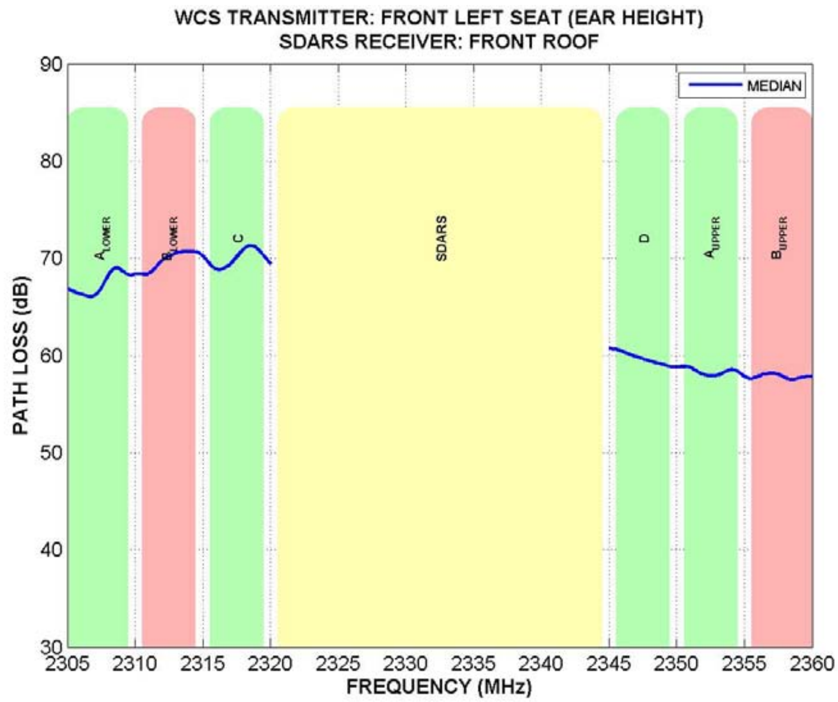


Figure B-1. Path Loss Between WCS Transmitter at Ear Level in Front Left Seat and Forward Roof-Mounted SDARS Receiver

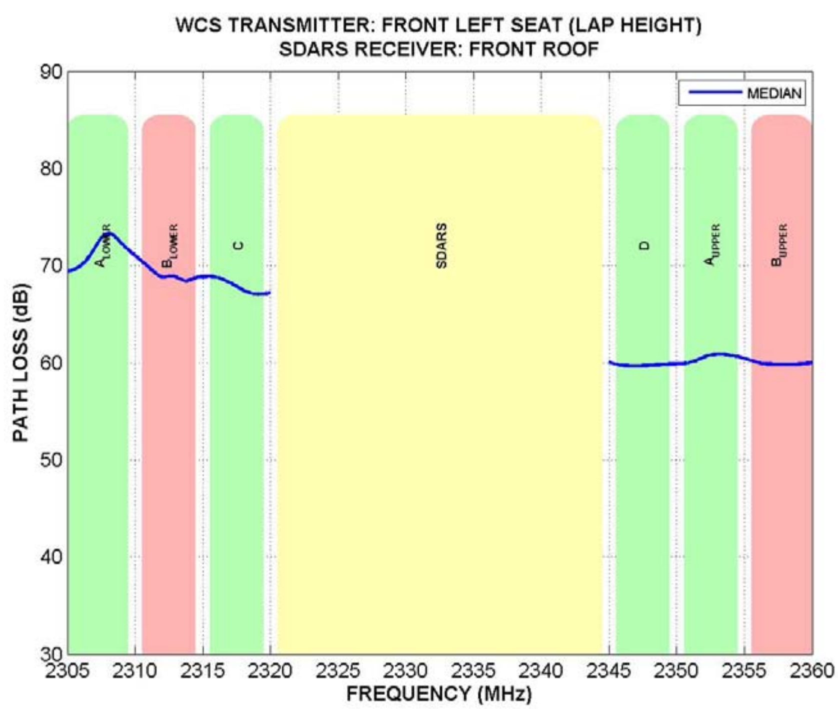


Figure B-2. Path Loss Between WCS Transmitter at Lap Level in Front Left Seat and Forward Roof-Mounted SDARS Receiver

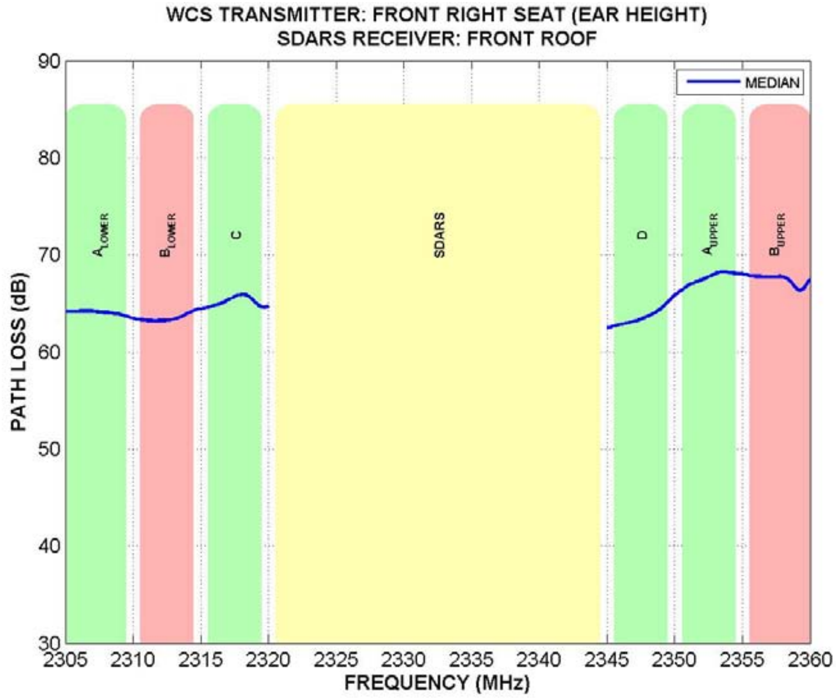


Figure B-3. Path Loss Between WCS Transmitter at Ear Level in Front Right Seat and Forward Roof-Mounted SDARS Receiver

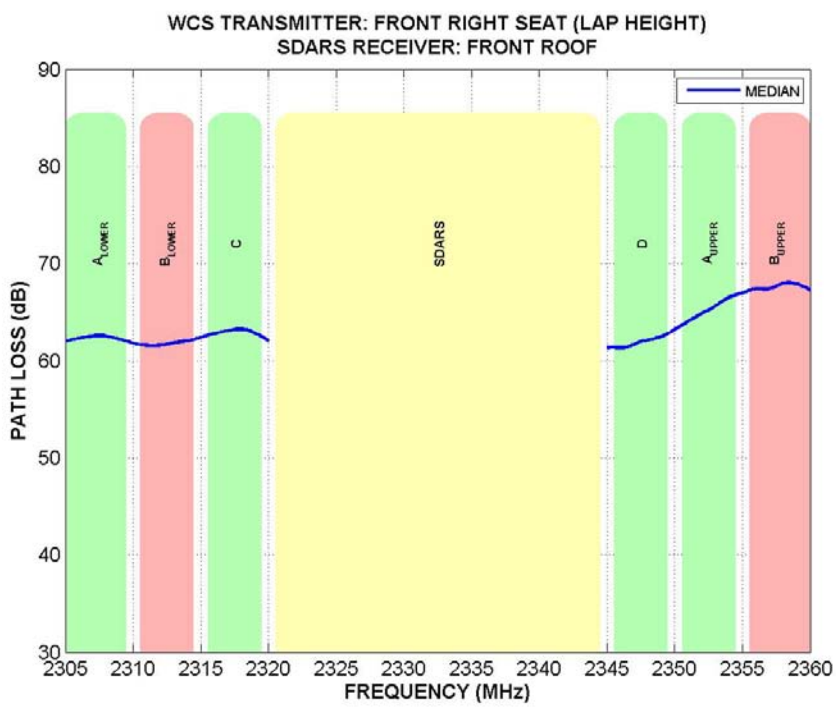


Figure B-4. Path Loss Between WCS Transmitter at Lap Level in Front Right Seat and Forward Roof-Mounted SDARS Receiver

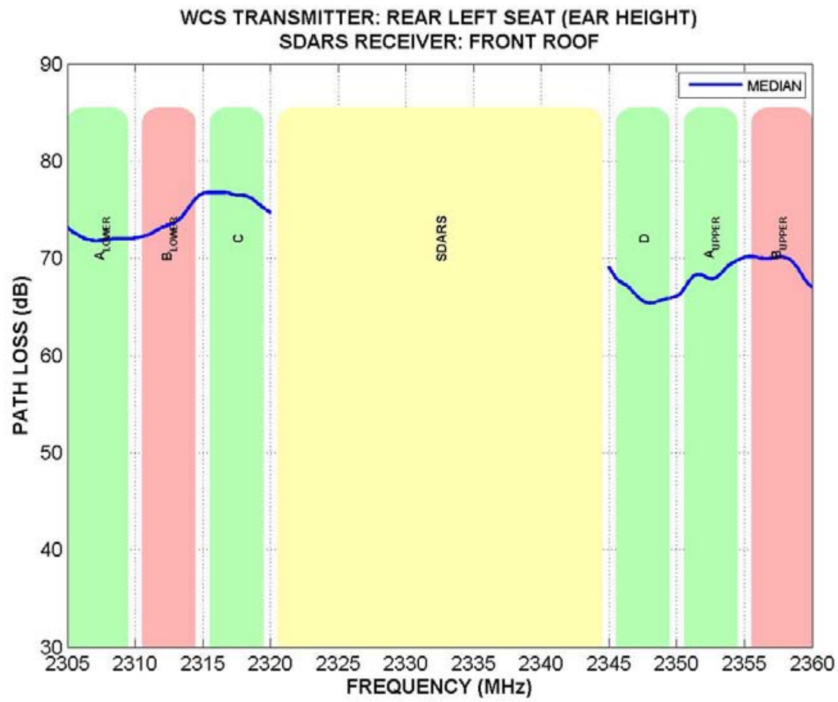


Figure B-5. Path Loss Between WCS Transmitter at Ear Level in Rear Left Seat and Forward Roof-Mounted SDARS Receiver

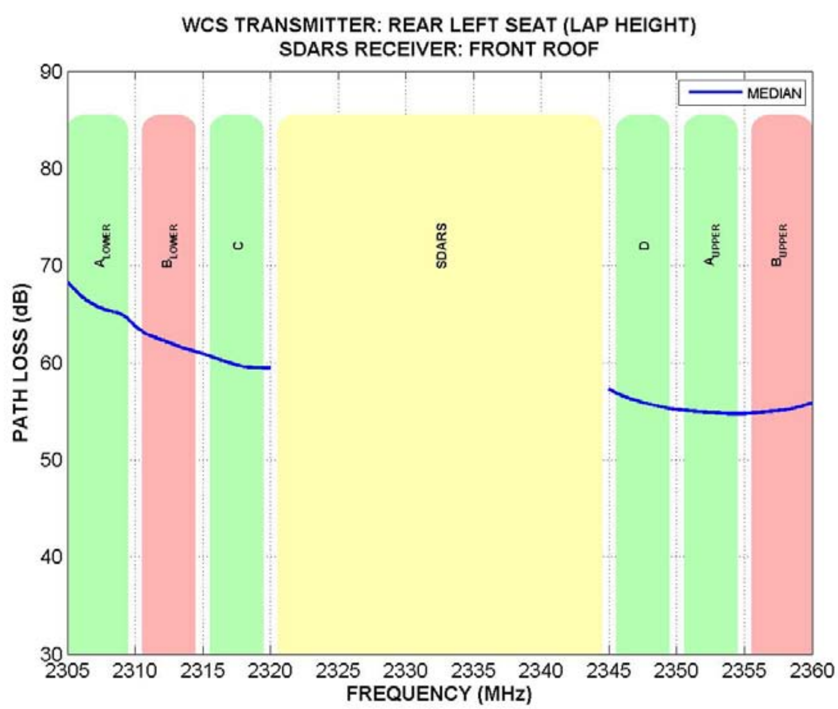


Figure B-6. Path Loss Between WCS Transmitter at Lap Level in Rear Left Seat and Forward Roof-Mounted SDARS Receiver

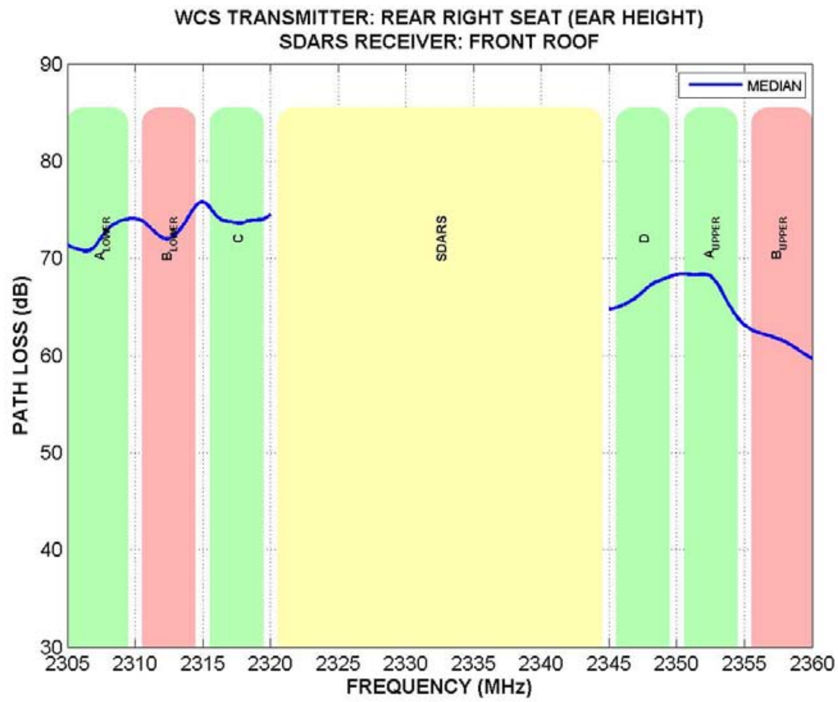


Figure B-7. Path Loss Between WCS Transmitter at Ear Level in Rear Right Seat and Forward Roof-Mounted SDARS Receiver

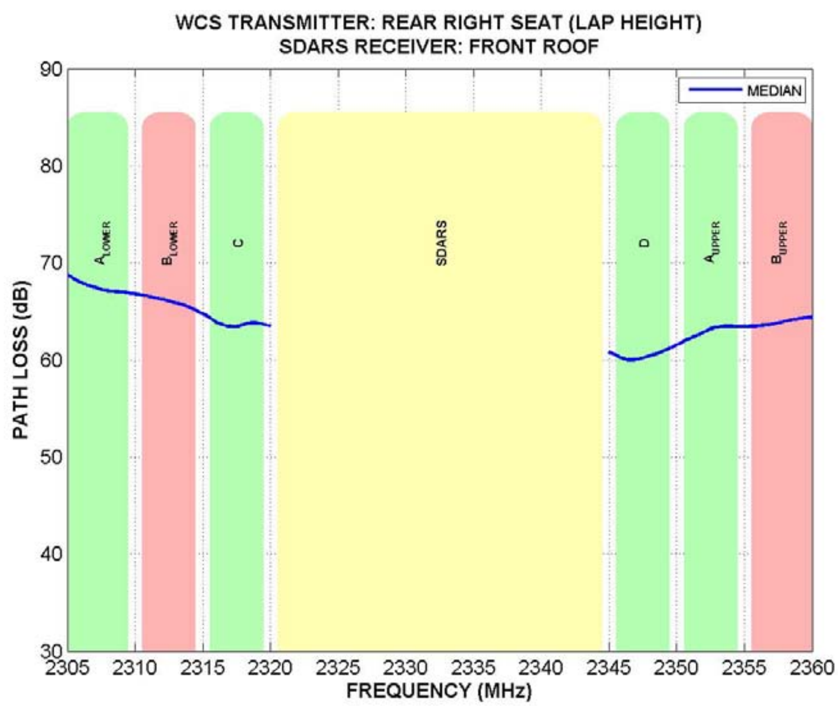


Figure B-8. Path Loss Between WCS Transmitter at Lap Level in Rear Right Seat and Forward Roof-Mounted SDARS Receiver

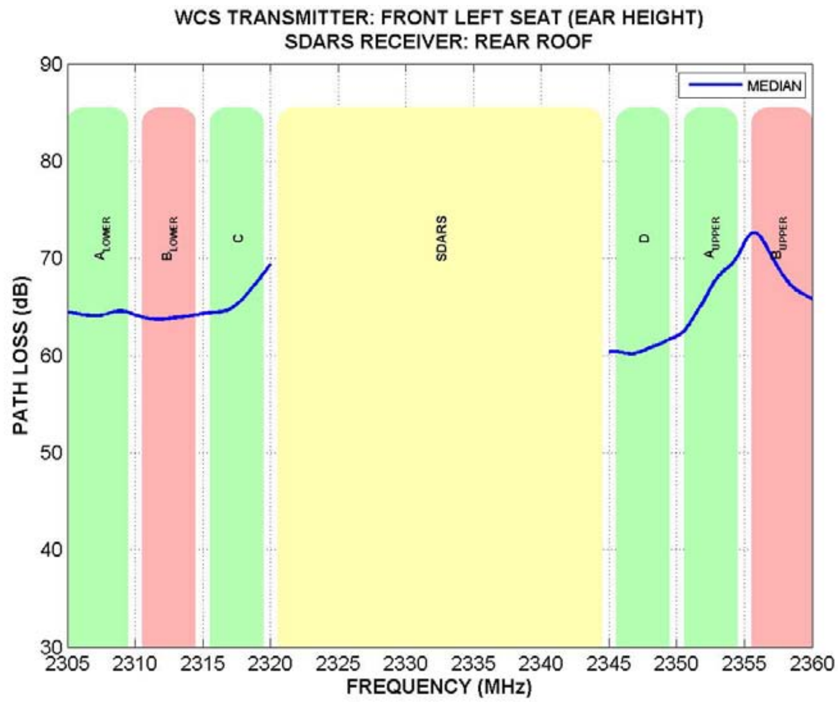


Figure B-9. Path Loss Between WCS Transmitter at Ear Level in Front Left Seat and Rear Roof-Mounted SDARS Receiver

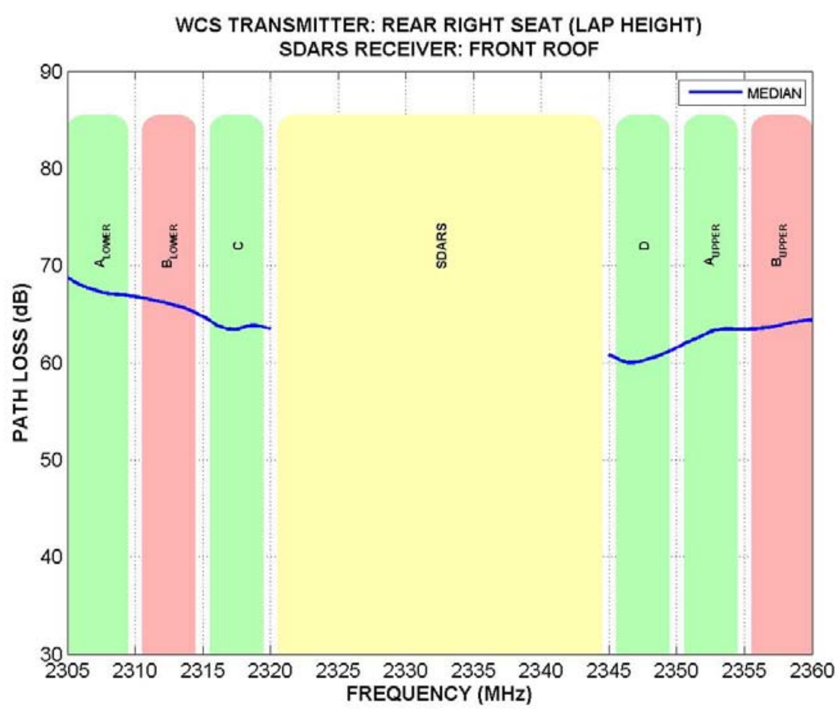


Figure B-10. Path Loss Between WCS Transmitter at Lap Level in Front Left Seat and Rear Roof-Mounted SDARS Receiver

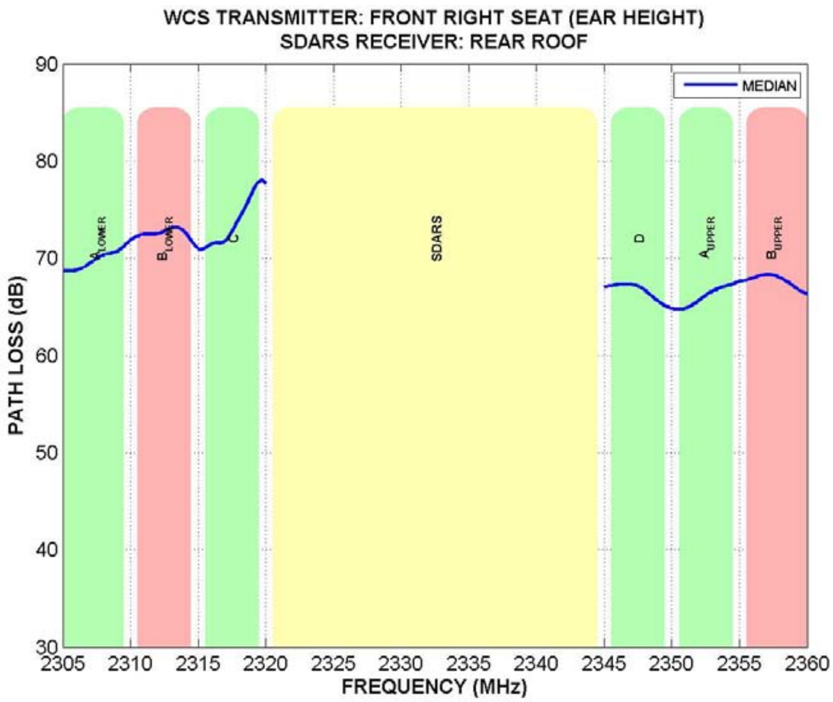


Figure B-11. Path Loss Between WCS Transmitter at Ear Level in Front Right Seat and Rear Roof-Mounted SDARS Receiver

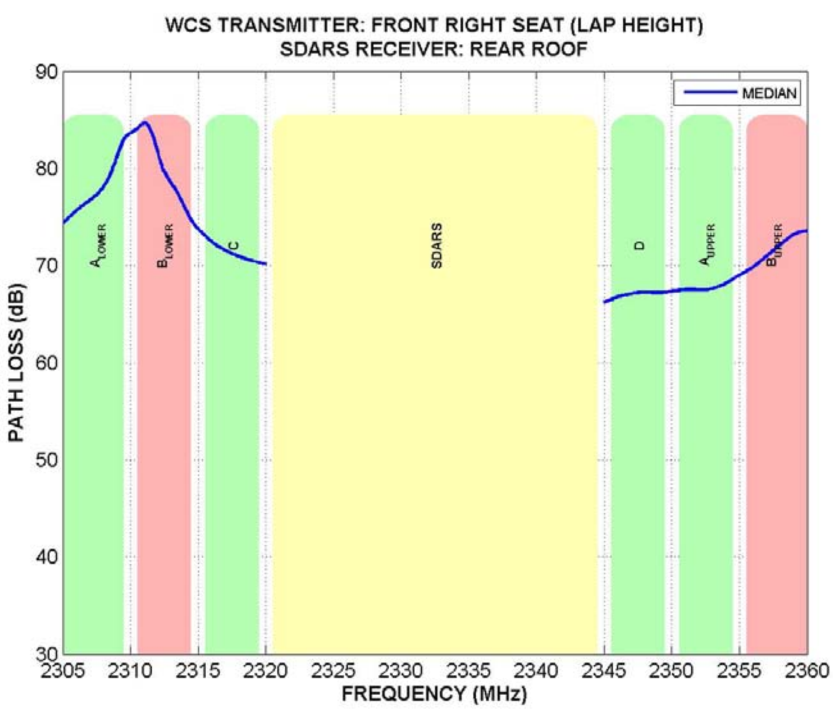


Figure B-12. Path Loss Between WCS Transmitter at Lap Level in Front Right Seat and Rear Roof-Mounted SDARS Receiver

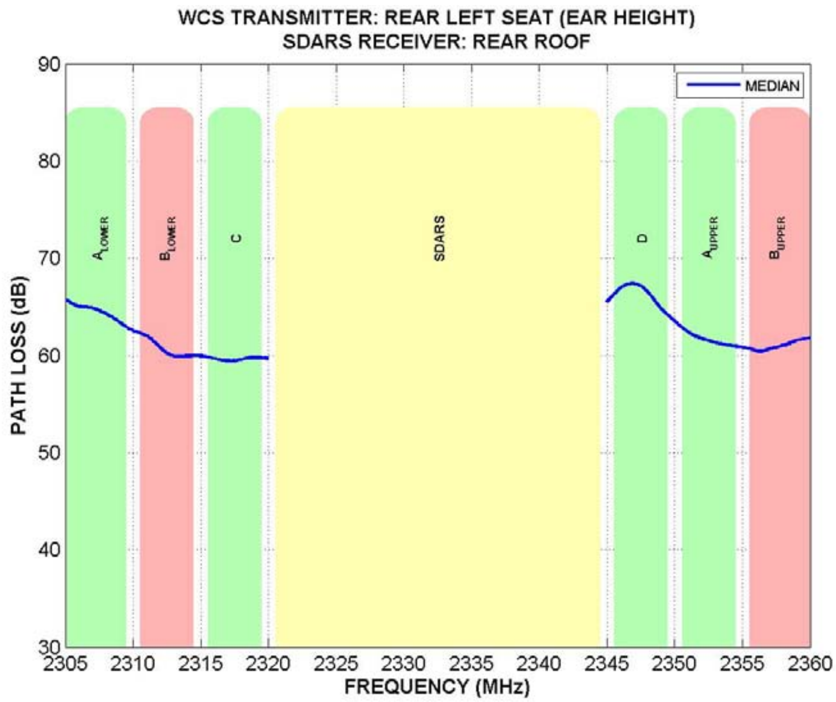


Figure B-13. Path Loss Between WCS Transmitter at Ear Level in Rear Left Seat and Rear Roof-Mounted SDARS Receiver

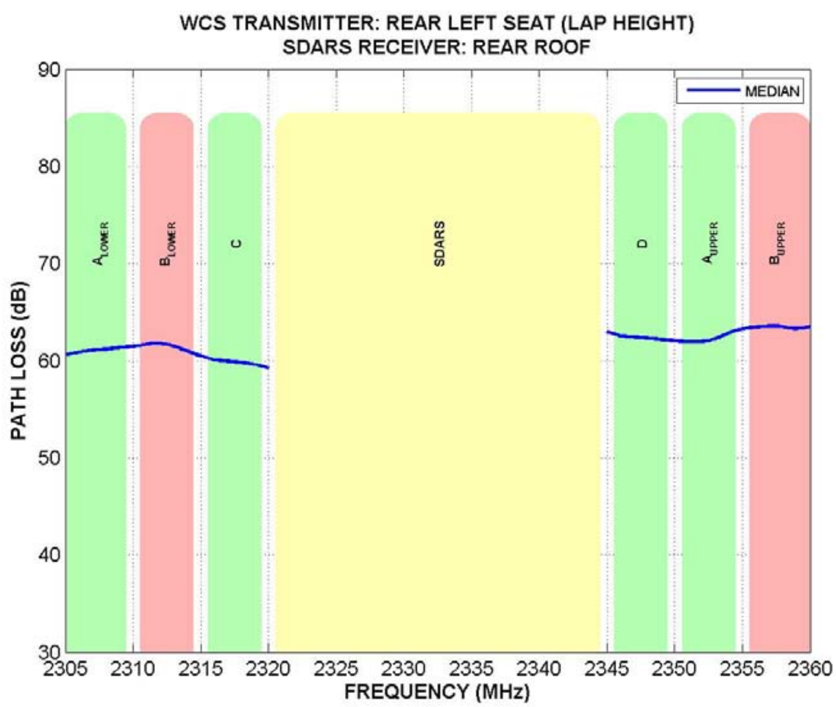


Figure B-14. Path Loss Between WCS Transmitter at Lap Level in Rear Left Seat and Rear Roof-Mounted SDARS Receiver

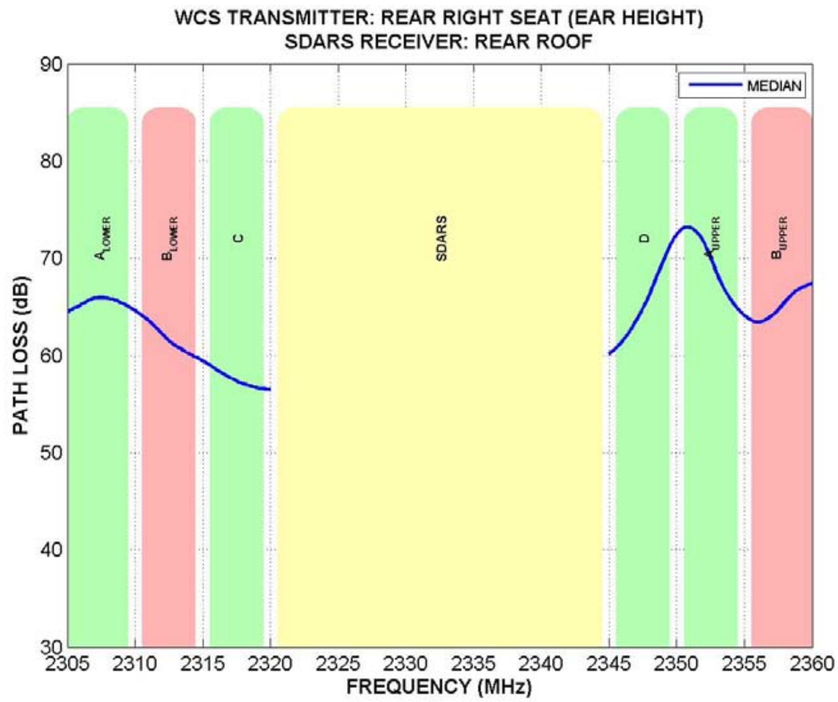


Figure B-15. Path Loss Between WCS Transmitter at Ear Level in Rear Right Seat and Rear Roof-Mounted SDARS Receiver

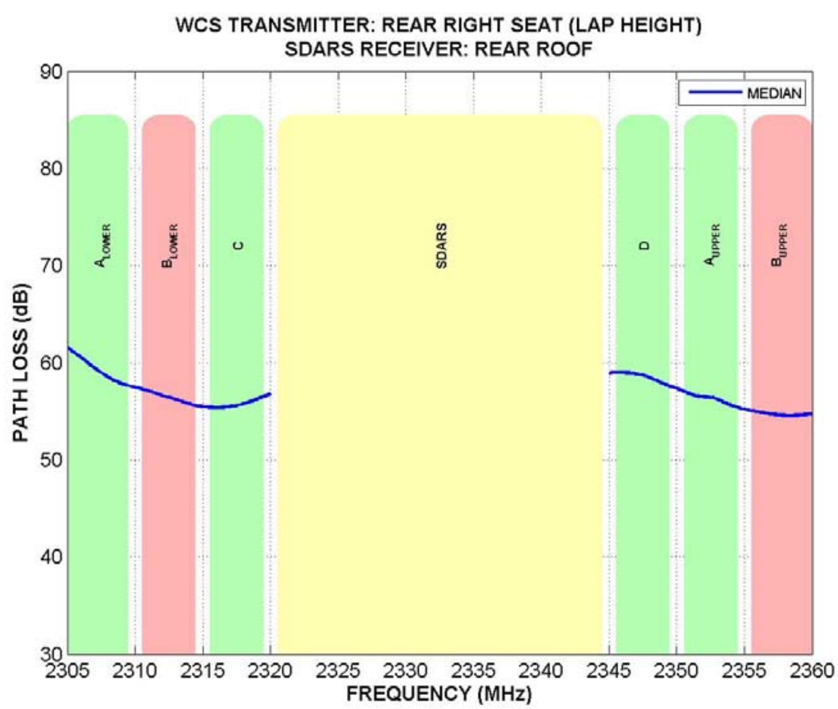


Figure B-16. Path Loss Between WCS Transmitter at Lap Level in Rear Right Seat and Rear Roof-Mounted SDARS Receiver